an account of his observations on the structure of the chorion and micropyle in the eggs of insects. —— Professor A. S. Packard, Providence, R. I., desires alcoholic specimens of Poduridæ and other Thysanura with a view to a future monograph of this order. He will gladly name any specimens sent him for identification. ——Dr. Heylaerts publishes in the Compte-rendu de la Société entomologique de Belgique (p. CCVII), remarks on the Psychides of the United States. He believes that other genera of these sack-bearing caterpillars will be discovered, such as the Epichnopteryx, Bijugis and Fumea, though he adds that not an European species has yet been discovered here. He describes from Professor Riley's collection *Chalia rileyi*, and notices a series of seven cases of unknown species, all, except one from Brazil, being from the Southern and Western States and Territories.——An Asiatic species of Corydalus (*C. asiatica*) resembling in size and appearance our *C. cornutus*, is described and figured by J. Wood-Mason in the Proceedings of the Zoölogical Society of London (1884, p. 110). It occurred at the Naga hills, N. E. frontier of India. All the previously described species of this genus are American.

ZOÖLOGY.

THE DEEP SEA EXPLORATIONS OF THE "TALISMAN."—The official report by M. A. Milne-Edwards, of the last expedition of the *Talisman*, has been published and translated by the *Independent*. The expedition of 1883 was divided into several distinct steps, the aim being to examine: 1. The coast of Africa as far as Senegal, then the shores of the islands of Cape Verde, of the Canaries and Azores, and, finally, to examine the Sargasso sea and study its surface fauna as well as the nature of its depths.

In one of the first trials on the coast of Spain, the *Talisman* party found an accumulation of dead shells, having the aspect of the pliocene fossils of Sicily, and among which M. Fischer recognized *Cypridina islandica* and *Mya truncata*, which are common in boreal seas and do not live south of England. They were associated with some Mediterranean or pliocene shells. Off the coast of Morocco and the Sahara were found, at the depth of 500 to 600 meters, numerous fishes (Macrurus, Melanocephalus, Hoplostethus and Pleuronectes), crustaceans such as certain undescribed shrimps with an enormous rostrum, pointed like a sword, which was named Pandales; other shrimps of the genera Penæus, Pasiphaea, some small crabs (Etalia, Portunus and Oxyrhynchus), some red Holothurians, examples of the soft-shelled sea-urchin (Calveria), which formerly lived in the chalk formation; also many large-sized sponges, some in the shape of an enormous chapeau (Askonema), the others lamellated (Farrea), the others more or less globular.

Deeper down, toward 1000 and 1500 meters, fishes abounded;

there were still Macruri, to which may be added species of Bathynectes, Coryphenoides, Malaccocephalus, Bathygadus, Argyropelecus, Chauliodus, Bathypterois, with fins transformed into tactile appendages (*B. longifilis*), Stomias, Malacosteus, with the skin of an intense black, and with phosphorescent jugal plates; Alepocephalus, etc. All these fishes, on arriving at the surface, were dead, the gas was separated from the blood, so as to produce a sort of froth, and many of them were deformed by the enormous distention of their swimming bladder. The species of this group, which inhabit the abysses of the sea, have a special aspect, and are readily recognizable. Their skin, covered with a very thick coat, never has lively colors; it is grayish, or of a velvet black, and the scales are not very solidly attached; the muscles are not thick, and are of a soft consistence; their bones are soft and have a spongy structure; their mouth is usually large, and armed with sharp, hook-like teeth. Most of these fishes live in the ooze, or at its surface. All that were observed by the *Talisman* party had normally developed eyes, whose mode of action in a medium completely obscure would be difficult to understand, if it did not find its explanation in the existence of phosphorescent plates, or of a covering of luminous slime, which can shine at a certain distance. In the black Malacosteus these plates are situated at the eyes; in other species they are disposed in lines on the lateral parts of the body.

The Pandali have given place to the Heterocarpus, with the carapace furnished with projecting edges; to species of Penæus, whose posterior feet resemble antennæ, and to enormous shrimps of a blood-red color, and with extremely long antennæ, which were previously unknown, and should be placed in the genus Arista.

These crustacea were common, and several times they were caught in such abundance that the cook claimed his share of them. The Nephropsis appeared at this level; they are blind crustacea, which externally resemble some kinds of crayfishes, of a coral red. Their geographical distribution seems to be very extensive; for they have been found on each side of the Atlantic, in the Antilles, while a Chinese species which seems to be identical, at least very near, has been dredged at a great depth near the Andaman islands.

The Pentacheles and the Polycheles, whose eyes are atrophied, conceal themselves in the ooze, only extending their long, slender pincers adapted to seize their prey. They alone represent in actual nature the Eryons, so common in the jurassic seas.

The Nematocarcini, with remarkably long feet, live in the same conditions. The crabs have become rarer, though some species still exist. These are the Maians (Scyramathia, Lispognathus), some Homolians of a new species, Lithodes of great size, heretofore peculiar to Arctic and Antarctic seas. A very large Lithodes

was dredged by the *Talisman*, under the tropics, at the depth of 900 and 1000 meters. This species, distinct from all others yet known, has been named *Lithodes tropicalis*. There also occurred several crustacea of the group Galatheæ, whose eyes are transformed into spines.

The sponges are extremely common at the surface of the bed of this part of the ocean. Most of them, as well known, have a silicious skeleton.

Several species of the beautiful Rosella and of Holtenia were found living in profusion. Their long hairs of white silex are buried in the mud, and the sponges, with a form like a rounded vase and a narrow orifice, project above the mud. They were especially numerous between 900 and 1200 meters, and at certain points they seem to form veritable beds. The Aphrocallistes, whose solid framework, composed of regular cells, affects the most elegant forms, and gives the appearance of a honeycomb, form extensive banks; they were found ordinarily associated with, and attached to, branching corals of the genera Lophohelia and Amphihelia.

The soft sea-urchins, such as the Calveria, become more numerous, and at 1000 meters they probably live crowded together like the Echini of our shores. Some Holothurians, of the genus Loetmogone, and other species of the same family creep among them; numerous starfishes, Ophiurans and Brisingas, are also associated there. Otherwise the fauna changes according to the nature of the bottom, and where the mud gives a foothold to the polyps, we find in these new conditions a different population.

Off Cape Ghir and Cape Noun, under the 30th parallel, at 120 miles from the shore, the *Talisman* explored, for several days, a very regular bank, whose depths only varied between the narrow limits of 2075 to 2300 meters. It was on this same bank that, on the 2d of August, 1882, the *Travailleur* brought up in its nets the singular fish described by M. Vaillant under the name of *Eurypharynx pelecanoides*, associated with a great number of new or rare species. This year two specimens of Eurypharynx have been captured, one at 1050 meters and the other at 1400 meters, on the bottom of the reddish ooze west of Morocco. Similar banks, but less rich, had been already explored by the *Talisman* on the Morocco coast, off Rabat, between Cape Blanc, northerly, and Cape Cantin, a little before the arrival of the *Talisman* at Mogador. These were found again under the 24th parallel; also off the Arguin bank. At this depth, the fishes were represented by some very rare species, such as the *Melanocetus johnsoni*, which had been as yet known only by a single example found floating on the water by fishermen near Madeira. With its enormous mouth it could swallow a fish considerably larger than its own body, and its prey would lodge in a sac which hangs below its abdomen. The first ray of the dorsal fin is developed into a true

tactile appendage, recalling that of the anglers, and serving the same purpose. Some Bathytroctes, a Stomias with phosphorescent plates, several Malacostei and some Halosaurus live also on the same oozy bottom. Many Crustacea, new to science, were here dredged, and belonging principally to the group of Galatheæ of the genera Galathodes, Galacantha, and Elasmonotus, whose eyes, deprived of any cornea, are covered with an orange colored pigment, and should be useless for vision. With them were dredged several new kinds of mollusks, among them a Dentalium of large size (*D. parfaiti*) and a Pholadomiya.

Between Senegal and the Cape Verde islands, the bottom, at a depth of from 3210 to 3655 meters, consisted of a greenish mud rich in life. Some of the animals found there did not differ from those found on the bank situated at the depth of 2300 meters.

Others presented peculiar characteristics. These were fishes of the genus Bathynectes, Synaphobranchus, and Myrus, some Aristes, with bright colors and very like those at depths of from 1000 to 1200 meters, but with smaller eyes. Among Crustacea were Pasiphaës, hermit crabs and Mysidæ. Among mollusks were a new species of Bulla, and another gasteropod belonging to an unknown genus (*Oocorys sulcata* Fischer); among Echinoderms were species of Ctenodiscus, Ophiurans, and species of Ophiomusium.

Between St. Antoine and St. Vincent the fauna surpassed in richness any regions previously explored. July 29th, at a depth of from 450 to 600 meters, the dredge came up at the end of an hour charged with more than a thousand specimens of fishes belonging mostly to the genus Malacocephalus; with more than 1000 Pandali, 500 amphipods, with long feet, a new species of Nematocarcinus, 150 Pasiphaës spotted with red, large carmine-red Aristes, and many other forms.—*To be continued.*

The Depth to which Sunlight Penetrates Water.—The much-discussed question as to the depth to which sunlight penetrates water, and the influence which such penetration, or want of penetration, may exert upon the phenomena of life at great depths has attracted renewed attention of late on the part of both physicists and biologists. The carefully conducted observations of Professor F. A. Forel, of Geneva, made upon the Lake of Geneva in 1874, proved—at least as far as the resources of photography and the human retina permitted—that the limit of absolute darkness in that lake was reached in summer at the very moderate depth of 45 meters, and in winter at 100 meters. Under normal conditions of sight a shining object disappeared when immersed below 16 to 17 meters. Asper, who continued the researches of Forel upon the Lake of Zurich, found in 1881 that photographic plates sensitized with bromide of silver emulsion indicated the penetration of light to at least 90 meters. But while the researches here recorded fix the limit of luminous perception as

dependent upon the powers of the human retina, they do not necessarily determine the same for the retina and visual nerves of the lower animals. Indeed, the presence of well-developed eyes in many of the animal forms inhabiting the greatest depths, no less than the varied coloring of their teguments, have frequently been taken in evidence to prove not only the existence of light there, but also the unequal visual powers of the different organisms. Professor Verrill has recently enunciated the startling proposition that not improbably light of the intensity of ordinary moonlight may penetrate to depths of 2000, or even 3000 fathoms, and that possibly some sunlight penetrates even to the lowest bottom of the ocean. Evidently, however, the tegumentary coloring as we observe it has no bearing on the question at issue, inasmuch as it appears as such only when brought within the influence of white light, which may be at, or quite near to, the surface of the water. Whether or not the quantity of phosphorescent light emitted by the organisms themselves is sufficient to account for the full development of visual organs, still remains to be proved. In the meantime, the recently conducted investigations of a special committee of Swiss scientists, among whose names we find those of Sarasin, Soret, Pictet, C. De Candolle, and Fol, seem to affirm in a general way the conclusions reached by Forel—namely, that luminous penetration extends to only moderate depths. Three candles (contained in a lantern), immersed in the clearest water of the Lake of Geneva, were visible at a depth of 30 meters; and an electric light, at 3 meters further. The distance of clear vision was found to be but very feebly dependent upon either the increase of brilliancy in the luminous body, or its absolute magnitude. The extreme limit of the sun's luminous action was determined photographically to be 250 meters, beyond which absolute darkness was supposed to prevail. —*The Nation.*

On the Structure of the Brain of Asellus and the Eyeless form Cecidotæa.[1]—The results presented grew out of an attempt to compare the nervous system, particularly the brain and other cephalic ganglia, of the eyeless species of cave-inhabiting Crustacea and insects with the allied eyed forms. After describing the brain and organs of sight of the common water sowbug (*Asellus communis*), with it was compared those of the blind asellid, *Cecidotæa stygia* Packard, which is so common in the brooks of Mammoth and other caves, and in the wells of southern Illinois and Indiana. Studies of this nature seem well calculated to throw light on the origin of the cave forms, and to show what great modifications have been produced in these organisms by a radical change in their surroundings; consisting as the latter do mainly of the absence of light and perhaps of the usual food, or at least the usual amount of food.

[1] Read at the Newport Meeting of the National Academy of Sciences, Oct. 4, 1884.

After describing the hitherto unknown peculiarities of the brain of Asellus and isopod Crustacea in general, the histological elements, and the optic lobes, nerves, and eyes, the brain of the eyeless forms was then described. Cecidotæa in its external form is a somewhat dwarfed Asellus, with the body, however, much longer and slenderer than in the eyed forms, and with slenderer appendages. It is not usually totally eyeless, since in some individuals a rudimentary eye, in the shape of a minute black speck, is seen on each side of the head; the spot varying in size in different individuals.

From the examination of numerous microscopic sections it appears that the eyeless Cecidotæa differs from the eyed form (Asellus) in the complete loss of the optic ganglia, the optic nerves, besides the almost and sometimes nearly total loss of the pigment cells and lenses. As regards the other parts of the brain, no differences were observed; the proportions of the brain and the histological structure had remained unchanged in the eyeless forms. Besides the atrophy of the optic ganglia and nerves, the pigment mass forming the retina and also the lenses exist in a very rudimentary condition. In one specimen the number of lenses was reduced to two, and the lenses themselves many times smaller than in the eye of the normal Asellus.

The steps taken in the degeneration or degradation of the eyes, the result of living in perpetual darkness, seem to be these:

1. The total and nearly or quite simultaneous loss by disuse of the optic ganglia and nerves.

2. Breaking down of the retinal cells.

3. The last step being, as seen in the totally eyeless forms, the disappearance of the lens and retina.

That these modifications in the eye of the Cecidotæa are the result of disuse and the loss of the power of vision from the absence of light seems well established; and this, with the many parallel facts in the structure of other cave Crustacea, as well as insects, arachnids, and worms, seemed to the author to be due to the action of two factors: (*a*) change in the environment and (*b*) heredity. Thus one is led by a study of these instances, in a sphere where there is little if any occasion for the exercise of a struggle for existence between the organisms, to a modified form of Lamarckianism in order to account for the origination of these forms, rather than the theory of natural selection, or pure Darwinism, as such.—*A. S. Packard.*

On the Morphology of the Tarsus in the Mammals.—While occupied with an extended paper on the limb-skeleton of the vertebrates, I have obtained some new views on the homology of the tarsal elements in the Mammalia. For some time I have been puzzled by a bone in the tarsus of different mammals, which has always been considered a "*sesamoid.*"

Flower (Osteol. of Mamm., 2d edit., p. 317) says of this bone:

" There is a large sesamoid bone on the tibial side of the tarsus, articulating with the astragalus, navicular and internal cuneïform."

Gegenbaur, who has done so much for the morphology of the limbs of vertebrates, says in regard to this:[1]

" EineVermehrung der Tarsuselemente ist bei Nagethieren vorhanden, von *Cuvier* wie von *Meckel* ausführlich beschrieben. Es wird dieseVermehrung aus einer Theilung des Naviculare abgeleitet und aus dem Hinzutreten eines überzähligen Knochens, der am inneren Fussrande des Cuneiforme 1 angelagert ist. Der aus der Theilung des Naviculare entstehende zweite Knochen liegt gleichfalls am inneren Tarsus rande, hinter dem vorhin erwæhnten, ist dem Kopfe des Astragalus seitlich angefügt und stösst überdies noch mit dem eigentlichen Naviculare und auf eine kurze Strecke mit dem Cuneiforme 1 zusammen. Wenn auch seine Lagerung am Astragalus und seine Verbindung mit dem eigentlichen Naviculare die Ansicht von seiner Entstehung, wie sie die oben genannten Autoren äussern, als sehr wahrscheinlich erscheinen lassen, so halte ich sie doch noch nicht für fest begründet. Das Vorkommen des zweiten Knochens, sowie ähnlicher überzähliger Stücke am Tarsus der Monotremen schliesst die Möglichkeit nicht aus, dass auch das aus einer Theilung des Naviculare entstanden sein sollende Stück ein Accessorium ist. Daran wird wenigstens so lange festgehalten werden dürfen, bis der Nachweis einer Theilung der Naviculare aus der Entwicklung geliefert ist."

I do not consider this bone a sesamoid for the following reasons:

1. Its situation. It articulates by distinct and well-developed faces with the first cuneïform (Tars. 1), at the proximal prolongation of which it is situated, and with the navicular and astragalus. In many *rodents* it articulates with the entire surface of the first cuneïform.

2. Its origin. In Cavia it is always found equally developed with the other tarsal bones and quite distinct.

3. Its relationship in certain phylogenetic old rodents, Cercolabes and Erethizon. In these forms there is always developed a claw-like piece of bone, articulating with the "sesamoid" in question, and hence it loses all the characters of a " sesamoid." It is surrounded by the astragalus, navicular, cuneïform 1 and the claw-like piece.

G. R. Waterhouse (A natural history of the Mammalia, Vol. II, Pl. 18, Fig. 4) gives an excellent figure of the tarsus of *Cercolabes novæ hispanæ*, but he calls these elements " supernumerary bones " (pp. 405–406).

Let us examine the relationship of this bone in some other orders

[1] Gegenbaur, C. Untersuchungen zur vergleichenden Anatomie der Wirbelthiere, 1 Heft. Carpus and Tarsus. Leipzig, 1864.

of mammals. In Hyrax I find a small bone between the astragalus and navicular, which I can only homologize with the "sesamoid." In the carnivores it appears to be coalesced with the navicular, as in Lepus, for I always find in the ascending part of the navicular traces of a former separation. In an embryo of a dog of 65^{mm} I have observed indications of a former distinction. In a recent examination of Ornithorhyncus[1] I have observed the same condition as in Cercolabes; the spur of the former is homologous with the claw-like piece in this rodent. A similar condition is found in many Edentates.

The question now is, what is the homologue of this bone? I can only compare it with the tibiale. The astragalus would then be homologous with the intermedium, the calcaneum with the fibulare.

I reach the conclusion: First, by the position of the piece in question; it lies in the first row of tarsal bones next to the astragalus; second, by the development of the tarsus of mammals. I never have been able to distinguish an "intermedium" in the sense of Bardeleben. In embryos of mammals, I have always found the astragalus composed of one piece, and I never find an element between the astragalus and calcaneum. In adult mammals, especially in Marsupials, I find Bardeleben's "intermedium" well developed, but I only consider it a tendon ossification.

The terminology of the tarsus of mammals would be the following:

Tibiale	=	Sesamoid.
Intermedium	=	Astragalus.
Fibulare	=	Calcaneum.
Centrale	=	Naviculare (Navic. = Centr. + Tib.).
Tarsale I	=	Cuneiform I.
Tarsale II	=	Cuneiform II.
Tarsale III	=	Cuneiform III.
Tarsale IV + V	=	Cuboideum.

If we seek for connecting forms among the vertebrates below the mammals, we must bear in mind the Theromorpha from the Permian recently described by Cope, which show so many resemblances to the mammals, especially in the tarsal bones. I do not hesitate to consider the claw-like piece in the tarsus of Cercolabes and Erethizon and the spur in the monotremes as the rudiment of a sixth toe, and would like to compare it with the same structure seen in the tarsus of frogs.

In my paper on the morphogeny of the carpus and tarsus of the vertebrates I will speak further on this subject.—*Dr. G. Baur, Yale College Mus., New Haven, Conn., Oct., 1884.*

ZOOLOGICAL NOTES.—*Cœlenterates.*—Messrs. Koren and Danielssen have recently described fifteen new species of Alcyona-

[1] Cope, E. D., Paleont. Bull. No. 39, p. 46, 1884.

rians, most of which have been dredged in the Bergen and Drontheim fjords. The new genus Duva contains four species. It contains much branched forms, bearing several non-retractile polyps at the extremity of each branchlet. The polyps are provided with long acicular spicules, and branches, twigs, and septa are without calcareous deposit. *Gorgonia florida* Rathke belongs to this division. Another new genus Gondu, is so peculiar that it is considered the type of a new family of Pennatulids and even of a section of the order characterized by the fixity of the rachis, the presence of long calcareous spicules and the bilateral development of the pinnules. The colony is short and without a base. The spicules have a central canal, divided into four by septa. The only species, *G. mirabilis*, is of a beautiful orange, with dark red polyps. The remaining species belong to the alcyonarian genera Sarcophyton, Gersemia, Clavularia, Sympodium, and Haimea, the gorgonian genera Brianeum and Paragorgia, and the pennatulid genera Gladiscus, Kophobelemnon, Leptotilum and Pinnatula.

Worms.—M. J. G. de Man, of Leyden, has published a monograph of the nematodes of the Netherlands and of France. He describes forty-three species belonging to thirty-six genera, of which twenty are new. Terrestrial nematodes can usually be found in the earth attached to the roots of damp grass, and fresh created species abound upon the filaments of Confervæ and in the detritus of ponds and brooks.

Crustaceans.—Crustacea seem to be rare in Barentz sea, for the six Dutch expeditions have only obtained fifteen species. M. Weber, in the *Niederländische Archiv fur Zoologie*, gives a careful description of *Glyptonotus sabini* Kroyer.

Fishes.—Cases of hermaphroditism among fishes accumulate. Aristotle first noticed it among the Serranidæ, and his statements have been since verified. The peculiarity has been observed in three or four species of Serranus, and in sixteen other species of bony fishes, viz: *Box salpa*, *Charax puntazza*, *Chrysophrys aurata*, *Labrus mixtus*, *Pagellus mormyrus*, *Perca fluviatilis*, *Sargus annularis* and *S. saloaini*, *Scomber scomber*, *Gadus morrhua*, *G. merlangus*, *Lota vulgaris*, *Solea vulgaris*, *Clupea harengus* and *Cyprinus carpio*. The majority of these species are Physoclysti, but three are Physostomes. Hermaphroditism has also been observed among the Chondrostei (*Acipenser huso*, *A. sturio*), but not among the elasmobranchs or the dipnoans. In examples of *Centrolophus pompilio*, *Smaris alcedo*, and *Ophidium barbatum*, a mass of ovules has been seen to develop within the male gland in the midst of the spermatoblasts. M. Max Weber (Ueber Hermaphrodismus bei Fischen. Nied Tijd. vor der Dierkunde) gives an interesting anatomical description of two hermaphrodite fishes, a perch and a cod. He attributes hermaphroditism to the primordial sexual indifference

of the materials at the expense of which the genital glands are developed. This makes it possible that, while one part of these embryonic materials evolves the male sex, the other may suffer modifications in the direction of the female.

Reptiles.—The lizards of the genus Macroscincus, which are not known to occur on any other spot than the desolate volcanic islet of Branco, three and a half miles south-west of Santa Lucia (Cape Verde islands) are said by M. A. Milne-Edwards to be exclusively vegetable feeders of exceedingly timid disposition. They live in holes among the loose basaltic masses which strew the island. The largest example obtained by the naturalist of the *Talisman* was sixty centimeters in length.

Birds.—The report of the committee for obtaining observations of the migrations of birds at light-houses and light-vessels around and near the British islands, contains much interesting information. Light-vessels moored from five to fifty miles off shore are most favorably placed for such observations. At Heligoland, the rush of migrating birds is more marked and concentrated than anywhere on the English coast. The great rushes on the English east coast in 1883 were on September 21 and the two following days, with moderate cross-currents of air blowing over the North sea, on October 12 and 13, and from the 27th to the 31st of the same month. No less than eight Greenland falcons were shot on the west coast of Ireland during the past year. Not a tithe of the enormous immigration of the autumn returns by the same lines in the spring.

Mammals.—M. A. Milne-Edwards stated in 1871 that, as a result of an examination of the foetal development of Indris, Propithecus, and Lemur, he had concluded that the lemuroids had incontestable affinities with the herbivores. Since that epoch, M. A. Milne-Edwards has examined the embryos of Microcebus, Galago, etc., which yielded the same results, and lastly has dissected a foetus of the aye-aye. This was found to resemble in every essential character those of other lemuroids, while the foetal membranes were those of a typical lemur. The dentition of the young aye-aye is much less different from that of other lemurs than that of the adult, in consequence of the shedding and non-replacement of some of the milk-teeth. The abnormal characters of the species are developed as age advances.

EMBRYOLOGY.[1]

AN OUTLINE OF A THEORY OF THE DEVELOPMENT OF THE UNPAIRED FINS OF FISHES.[2]—The median fins of fishes normally present five well-marked conditions of structure which correspond inexactly to as many stages of development, which, in typi-

[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

[2] To appear in full in the Proceedings of the National Museum, with plates.